

REMARKS

This is a full and timely response to the Office Action mailed April 20, 2005.

By this Amendment, claims 12, 13, 15 and 17 have been amended to address the Examiner's objection and rejection set forth in the Action. Support for the claim amendments can be found variously throughout the specification and the original claims. Thus, claims 1-18 remain pending in this application, with claims 6-9 being withdrawn.

In view of this Amendment, Applicant believes that all pending claims are in condition for allowance. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

In support of the arguments herein below, Applicant has submitted a Rule 1.132 Declaration. Applicant notes that the Declaration and comments relating thereto are submitted in combination with our previously filed arguments for the Examiner's convenience. Applicant believes that the Declaration when combined with our previously filed arguments clearly establishes as fact under U.S. practice (*which the Examiner must accept*) that (1) Shimose et al. does not teach any adhesive polyimide possessing a mean etching rate of 0.5 $\mu\text{m}/\text{min}$ or more by a 50% aqueous solution of potassium hydroxide at 80°C, and (2) all polyimides disclosed in Mochizuki et al. or Takabayashi et al. have etching rates which are too low as compared to the present invention.

Objection to the Drawings

The drawings filed on February 15, 2002 are objected to by the Examiner because the lines are not clear and each object (i.e. (1)-(5)) in Figure 1 should be larger. Applicant has enlarged each object (i.e. (1)-(5)) in Figure 1 as per the Examiner's request. Thus, withdrawal of this objection is respectfully requested.

Objection to the Claims

Claims 15 and 17 are objected to for failing to present the full name of the term "HDD" in the preamble. Applicant has amended the claims to address this issue raised by the Examiner. Thus, withdrawal of this objection is respectfully requested.

Rejection under 35 U.S.C. §112

Claims 12 and 13 are rejected under 35 U.S.C. §112, second paragraph, for alleged indefiniteness. Applicant has amended the etching rates of polyimide A and polyimide B in claims 12 and 13 to be “*4.0 μm/min or more*” and “*1.0 μm/min or more*”, respectively. Thus, withdrawal of this rejection is respectfully requested.

Rejection under 35 U.S.C. §102

Claims 1, 2, 3, 5 and 14-16 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Shimose et al. (U.S. Patent 6,203,918). Applicant respectfully traverses this rejection.

As stated on our response filed January 27, 2005, to constitute anticipation of the claimed invention, a single prior art reference must teach each and every limitation of the claims. Here, in this case, Shimose et al. fail to teach the limitation *“the insulating resin layer having plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 μm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C.”*

Specifically, the claimed invention is directed to an *“hard disk drive (HDD) suspension to be obtained by processing a laminate which is constructed of an insulating resin layer and a metal foil successively formed on a stainless steel substrate, said laminate satisfying the following conditions;*

(1) the insulating resin layer having plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 μm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C,

(2) the layers in the insulating resin layer which exist in contact with the stainless steel substrate and the metal foil are those of polyimide (B) exhibiting a glass transition temperature of 300 °C or less, and

(3) the adhesive strength between the layer of polyimide (B) and either the stainless steel substrate or the metal foil is 0.5 kN/m or more”. It is also claimed in claim 2 that the insulating resin layer of the laminate comprises *“at least one layer of low-thermal-expansion polyimide (A) exhibiting a coefficient of thermal expansion of 30 × 10⁻⁶/ °C or less.”*

Based on claims 1 and 2, the simplest examples of the insulating resin layer structure of the laminate of the present claims are represented as follows:

S/(B)/M (corresponding to one of many embodiments in claim 1)

S/(B)/(A)/(B)/M (corresponding to one of many embodiments in claim 2)

(wherein (A) denotes a polyimide resin layer (A), (B) denotes a polyimide resin layer (B), S denotes a stainless steel substrate, and M denotes a metal foil). However, Applicant notes that other examples within the scope of the claims are also possible (see, for example, page 11 of the specification).

In order to produce the claimed HDD suspension from the laminate, the outer stainless steel substrate (“S”) and metal foil (“M”) are each first subjected to etching into a predetermined pattern. Then, the insulating resin layer ((B), or (A) and (B)) is subjected to etching by using the patterned S and/or M as resists.

To satisfy the requirements of HDD applications, the laminate of the present invention must 1) prevent warping and 2) have a high bonding strength between the resin and metal foil, or resin and stainless steel substrate. As discussed in the present specification and shown in the Examples, the prevention of warping can be attained by using a polyimide resin layer (A) having a low coefficient of thermal expansion (i.e. CTE of $30 \times 10^{-6}/^{\circ}\text{C}$ or less) similar to the CTE of the metal foil or stainless steel substrate, and providing a sufficiently thick laminate of polyimide resin layer (A)/(B). The high bonding strength between the resin and the metal foil or stainless steel substrate is attained by providing a polyimide resin (B) having a low glass transition temperature (i.e. Tg of 300°C or below) in contact with the metal foil or stainless steel substrate.

The high bonding strength and low coefficient of thermal expansion cannot be satisfied with one kind of polyimide resin. Prior art laminates focused on satisfying a low coefficient of thermal expansion and obtaining sufficient bonding strength. The rate of etching of the laminate and the insulating resin layer was not at all considered.

In general, polyimide resins (A) have a high rate of etching while polyimide resins (B) have a low rate of etching. A low rate of etching for polyimide resin (B) results in a long period of time between the start of the etching of polyimide resin (B) (*at the completion of etching of polyimide resin (A)*) and the completion of etching of polyimide resin (B) (*whereby the etching reaches the metal foil or stainless steel substrate*). During such a long period of time, the continued etching of other polyimide resin layers such as polyimide resin layer (A) may also proceed. However, the continued etching of the other polyimide resin layers proceeds not in the thickness direction but in the width direction, which is referred to as “*side etching*”. When side

etching occurs, precise etching cannot be performed since the portion of the resist larger than the patterned opening portion is also etched. Such problems have become more serious and important due to the increasing demand for fine interconnection structure.

The present invention solves these problems by teaching a insulating resin layer comprising “*plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 µm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C*” to thereby minimize the problems of side etching. In other words, the present invention specifies the rate of etching of the whole resin and the rate of etching of polyimide resin layer (B). Further, additional claims have been previously added (see claims 10-14) to specify the ratio of thickness of polyimide resin layer (A) and (B) and the rates of etching of polyimide resin layer (A) and (B) to minimize side etching. Such a structure and effect in the pending claims are not at all disclosed in the cited references.

Shimose et al. defines its rate of etching by immersing the layer of polyimides in 100% hydrated hydrazine at 50°C which is not equivalent to the “*50% aqueous solution of potassium hydroxide at 80°C*” defined by the present claims. Nevertheless, since the rate of etching depends on the resin structure (i.e. monomer composition) of the polyimides resins, the inventors of the present application have measured the etching rate of the adhesive polyimide described in Shimose et al. under the conditions described in the specification of the present invention. More specifically, Applicant has synthesized the adhesive polyimide layers described in the Examples of Shimose et al. and subjected them to etching by an aqueous solution of potassium hydroxide defined by the present claims. The etching rates of the adhesive polyimide layers of Shimose et al. were then measured, the results of which are submitted in the enclosed Rule 1.132 Declaration.

In Synthetic Examples 1 to 6 of Shimose et al., six types of polyimide precursors A to F were synthesized. Polyimide precursors A and B correspond to the precursor of the polyimide (A) layer of the present invention while polyimide precursors C to F correspond to the precursor of the polyimide (B) layer of the present invention which is in contact with the stainless steel substrate S and metal foil M.

Polyimide precursors C to F were synthesized in the same manner as in Synthetic Examples 3 to 6 of Shimose et al., and the respective etching rates were measured. As described in the Declaration and summarized in Table 1 below, the polyimide layers obtained from the polyimide precursors C to F each had an etching rate of less than 0.5 µm/min.

TABLE 1

Experiment 1 Polyimide C (Synthetic Example 3 of Shimose et al.)	0.3 $\mu\text{m}/\text{min}$
Experiment 2 Polyimide D (Synthetic Example 4 of Shimose et al.)	0.3 $\mu\text{m}/\text{min}$
Experiment 3 Polyimide E (Synthetic Example 5 of Shimose et al.)	0.1 $\mu\text{m}/\text{min}$
Experiment 4 Polyimide F (Synthetic Example 6 of Shimose et al.)	Less than 0.1 $\mu\text{m}/\text{min}$

Based on the experimental results shown in the enclosed Declaration, it is clear that Shimose et al. does not teach any adhesive polyimide and in particular, any polyimide resin (B) layers possessing *a mean etching rate of 0.5 $\mu\text{m}/\text{min}$ or more by a 50% aqueous solution of potassium hydroxide at 80°C*. The low etching rate of the adhesive polyimide in Shimose et al. provided a polyimide layer of a protruding shape like a canopy, and as a result, practical HDD suspension was not obtained. This result is similar to that of Comparative Example 1 described in the specification of the present invention, which supports that the etching rate of the polyimide resin (B) of the present invention is important.

Thus, in view of the above arguments and the enclosed Rule 1.132 Declaration, withdrawal of this rejection is respectfully requested.

Rejection under 35 U.S.C. §103

Claims 1-5, 10-14 and 17-18 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Shimose et al. (U.S. Patent 6,203,918) in view of Mochizuki et al. (U.S. Patent 5,578,696) and Takabayashi et al. (U.S. Patent 5,262,227). Applicant respectfully traverses this rejection.

As stated on our response filed January 27, 2005, to establish a *prima facie* case of obviousness, the cited references, in combination, must teach or suggest the invention as a whole, including all the limitations of the claims. As stated for the reasons outlined above, Shimose et al. fail to teach the limitation "*the insulating resin layer having plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 $\mu\text{m}/\text{min}$ or more by a 50% aqueous solution of potassium hydroxide at 80°C*." Such a deficiency in

Shimose et al. is not cured by the teaching and suggestions of Mochizuki et al. or Takabayashi et al.

Applicant synthesized the polyimide layers described in the Examples of Mochizuki et al. and Takabayashi et al. to measure their respective etching rates. As representative polyimide layers of Mochizuki et al., Applicant choose to synthesize Examples 1, 3, and 7 of Mochizuki et al. since (1) the polyimide layers used in Examples 1, 2, 4, and 5 of Mochizuki et al. are the same, (2), the polyimide layers used in Examples 3 and 6 are the same, and (3) the polyimide layers used in Examples 7, 8 and 9 are the same. Synthetic examples of the polyimide resins shown in Mochizuki et al. are as follows. Examples 1, 3, and 7 of Mochizuki et al. describe polyimides formed from (a) 4,4'-diaminodiphenyl ether (DAPE44) and 2,2'-bis(3,4-dicarboxyphenyl) hexafluoropropane (6FDA), (b) bis[4-(4-aminophenoxy) phenyl]propane (BAPP) and 4,4'-hydroxy diphthalic acid dianhydride (ODPA), and (c) 2,2-bis(trifluoromethyl)-4,4-diaminobiphenyl (TFMB) and 3,3',4,4'-biphenyltetracarboxylic acid dianhydride (s-BPDA), respectively.

As representative polyimide layers of Takabayashi et al., Applicant choose to synthesize Example 1 of Takabayashi et al. since the polyimide layers used in Examples 1 to 5 of Takabayashi et al. are the same. Example 1 of Takabayashi et al. describes a polyimide formed from 3,3',4,4'-biphenyltetracarboxylic acid dianhydride (s-BPDA) and 4,4'-diaminodiphenyl ether (DAPE44) and a polyimide formed from 3,3',4,4'-biphenyltetracarboxylic acid dianhydride (s-BPDA) and p-phenylenediamine (PPD). .

Unfortunately, the dianhydride used in Example 1 of Mochizuki et al. was not available. Hence, only the polyimide layers of Examples 3 and 7 of Mochizuki et al. and Example 1 of Takabayashi et al. were synthesized, and their respective etching rates were measured.

Based on the experimental results shown in the enclosed Declaration, all polyimides disclosed in Mochizuki et al. and Takabayashi et al. have etching rates lower than that defined in the claims. The polyimide layers of Examples 3 and 7 of Mochizuki et al. each had an etching rate of less than 0.5 $\mu\text{m}/\text{min}$, and the polyimide layer of Example 1 of Mochizuki et al. presumably has an etching rate of less than 0.5 $\mu\text{m}/\text{min}$, as noted in the Declaration. Likewise, the polyimide layer of Example 1 of Takabayashi et al. has an etching rate of less than 0.5 $\mu\text{m}/\text{min}$.

Such results are further confirmed by Synthetic Examples C and L in the specification of copending patent application 10/467,463 which shows the low rate of etching of polyimide using BAPP (0.2 $\mu\text{m}/\text{min}$ or less). Further, Synthetic Example S of patent application 10/467,463 shows the expected low rate of etching of polyimide using s-BPDA (0.1 $\mu\text{m}/\text{min}$) (which corresponds to BPDA). Such a conclusion is shown by the relationship between the composition of diamines and acid dianhydrides constituting polyimides and the etching quality from Table 3 of the Examples. In Table 3, S (polyimide) is prepared from BPDA and PMDA as acid dianhydride components, and APB and p-DAP as diamine components, and its etching quality is evaluated. The resulting rate of etching of 0.1 $\mu\text{m}/\text{min}$ falls dramatically short of the lower limit (i.e. 0.5 $\mu\text{m}/\text{min}$) of the present invention. Although there is a little difference in the composition of raw materials, Q and R, prepared from the same diamine components as S, showed good etching quality. Thus, the inferior etching quality of S unquestionably results from the use of BPDA.

Thus, as demonstrated by the experimental data of the enclosed Rule 1.132 Declaration and of copending patent application 10/467,463, the polyimide resins shown in Mochizuki et al. and Takabayashi et al. clearly do not satisfy the rate of etching requirement of the present claims. Hence, for these reasons, withdrawal of this rejection is respectfully requested.

Applicant wishes to note that the etching rate is determined mainly by polyimide itself, but the selection, combination, molar ratios, etc. of diamine and dianhydride used as raw materials are important. In the present invention, the precursors of the polyimide (B) layers are obtained from the following combination.

Synth. Ex.	PI precursor	diamine	dianhydride	Etching $\mu\text{m}/\text{min}$	CTE ppm	Tg $^{\circ}\text{C}$
1	A	DAMBA+DADE	PMDA	13.7	17.7	
2	B	BADP+DADE	PMDA+BPDA	2.1		235
3	C	BAPB+DAP	PMDA+DSDA	1.6		216
4	D	DAPE	PMDA+BPDA	0.8		286
5	E	BAPB+DAP	PMDA+TRDA	1.2		203
6	F	BAPP	PMDA+BPDA	0.2		280

Here, the abbreviations have the same meanings as those in the specification, and TRDA represents ethylene glycol bis(trimellitate anhydride). The polyimide precursor A of

Synthetic Example 1 is used for the polyimide (A) layer, and the polyimide precursors B to E of Synthetic Examples 2 to 5 are used for the polyimide (B) layer. The precursor F of Synthetic Example 6 is used for the polyimide (B) layer but has a low etching rate, and thus is regarded as a comparative example.

As described above, a plurality of types of diamine and dianhydride are used to obtain polyimide resin layers each having excellent adhesive strength and excellent etching rate. Therefore, the polyimide resin (B) layer of the present invention is hardly obtained by simply applying the methods described in the cited references. As the Examiner already knows, a showing of superior and unexpected properties can rebut a *prima facie* case of obviousness. *In re Papesch*, 315 F.2d 381, 137 USPQ 43 (CCPA 1963).

Thus, for also these reasons, withdrawal of this rejection is respectfully requested.

Applicant also wishes to submit that the Examiner has maintained the 35 U.S.C. §102 and §103(a) rejections based on the argument that the claimed etching rate would be inherent if the same concentration of aqueous potassium hydroxide solution (*i.e.* 50%) under the same condition (*i.e.* at 80°C) are utilized. However, as shown by the experimental data in the Rule 1.132 Declaration and explained in the arguments above, such is not the case.

Under U.S. case law, the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). In relying upon the theory of inherency, the Examiner *must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic (i.e. etching rate) necessarily flows from the teachings of the applied prior art*. In other words, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency may not, as applicable in this case, be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). Since, in this case, it is clear that the polyimide resins disclosed in Mochizuki et al. and Takabayashi et al. do not satisfy the rate of etching requirement of the present claims, it cannot be argued that the limitation "*the insulating resin layer having plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 µm/min or more by a 50%*

aqueous solution of potassium hydroxide at 80°C' **necessarily flows** from the teachings of Mochizuki et al. and Takabayashi et al.

Thus, the rejections under 35 U.S.C. §102 and §103(a) cannot be sustained and should be withdrawn.

Obviousness-Type Double Patenting Rejection

Claims 1-5 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-5 of copending Application No. 10/467,463. Applicant respectfully traverses this rejection.

Under U.S. case law, a double patenting rejection of the obviousness-type is “analogous to [a failure to meet] the nonobviousness requirement of 35 U.S.C. § 103. *In re Braithwaite*, 379 F.2d 594, 154 U.S.P.Q. 29 (CCPA 1967). Therefore, any analysis employed in an obviousness-type double patenting rejection parallels the guidelines for analysis of a 35 U.S.C. § 103. *In re Braat*, 937 F.2d 589, 19 U.S.P.Q.2d 1289 (Fed. Cir. 1991).

Thus, to establish a *prima facie* case of obviousness, claims 1-5 of copending Application No. 10/467,463 must teach or suggest the invention as a whole, including all the limitations of the claims. Here, in this case, claims 1-5 of copending Application No. 10/467,463 fails to teach or suggest “**an hard disk drive (HDD) suspension** to be obtained by processing a laminate which is constructed of an insulating resin layer and a metal foil successively formed on **a stainless steel substrate**”. In particular, claims 1-5 of copending Application No. 10/467,463 fails to teach or suggest the specific elements of “*an hard disk drive (HDD) suspension*” and “*a stainless steel substrate*”.

The Examiner responded to such arguments by indicating that the pending claims (i.e. claims 1-5) in both the copending Application No. 10/467,463 and the present invention are “*structurally similar*” and “*materially the same*”. However, the Examiner fail to address where in claims 1-5 of copending Application No. 10/467,463 does it teach or suggest the specific elements of “*an hard disk drive (HDD) suspension*” and “*a stainless steel substrate*”. As stated earlier, in order to establish a *prima facie* case of obviousness, claims 1-5 of copending Application No. 10/467,463 must teach or suggest the invention as a whole, including the claimed limitations of “*an hard disk drive (HDD) suspension*” and “*a stainless steel substrate*”. Applicant notes that the claims of copending Application No. 10/467,463 are directed to a

different invention (i.e. “*a laminate*”) than that of the present invention (i.e. “*an hard disk drive (HDD) suspension*”).

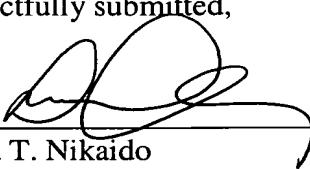
Thus, for these reasons, withdrawal of this rejection is respectfully requested.

CONCLUSION

For the foregoing reasons, all the claims now pending in the present application are believed to be clearly patentable over the outstanding rejections. Accordingly, favorable reconsideration of the claims in light of the above remarks is courteously solicited. If the Examiner has any comments or suggestions that could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the below-listed number.

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